



European  
Commission

# CHINA

CHALLENGES AND PROSPECTS FROM AN INDUSTRIAL AND INNOVATION POWERHOUSE

EXECUTIVE SUMMARY



6 80672 8 35

EUR 29737 EN

Joint  
Research  
Centre

This publication is a Science for Policy report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

#### Contact information

Xabier Goenaga Beldarrain

European Commission, Joint Research Centre, Rue du Champ de Mars 21, 1050 Brussels, Belgium

Email: [JRC-B7-SECRETARIAT@ec.europa.eu](mailto:JRC-B7-SECRETARIAT@ec.europa.eu)

Tel.: + 32 2 298 1114

#### EU Science Hub

<https://ec.europa.eu/jrc>

JRC116516

EUR 29737 EN

PDF ISBN 978-92-76-03405-6 ISSN 1831-9424 doi:10.2760/489414

Print ISBN 978-92-76-03404-9 ISSN 1018-5593 doi:10.2760/425812

Luxembourg: Publications Office of the European Union, 2019

© European Union, 2019

The reuse policy of the European Commission is implemented by Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Reuse is authorised, provided the source of the document is acknowledged and its original meaning or message is not distorted. The European Commission shall not be liable for any consequence stemming from the reuse. For any use or reproduction of photos or other material that is not owned by the EU, permission must be sought directly from the copyright holders.

All content © European Union, 2019 except: cover © European Union, 2019 - graphic elaboration from ©nakornkhai - AdobeStock and ©Roman Sotola, 2019 - Adobe Stock; p. 7, ©吴周, 2019 - AdobeStock.

Sources figures executive summary: Fig. 1 (JRC based on WIOD); Fig. 2 (JRC based on WIOD); Fig. 3 (JRC based on foreign ownership database); Fig. 4 (Nepelski et al, 2014); Fig. 5 (OECD/MSTI, ESTAT, Frietsch, 2019); Fig. 6 (Elsevier Scopus).

How to cite this report: Preziosi, N., Fako, P., Hristov, H., Jonkers, K., Goenaga, X. (eds) Alves Dias, P., Amoroso, S., Annoni, A., Asensio Bermejo, J.M., Bellia, M., Blagoeva, D., De Prato, G., Dosso, M., Fako, P., Fiorini, A., Georgakaki, A., Gkotsis, P., Goenaga, X., Hristov, H., Jaeger-Waldau, A., Jonkers, K., Lewis, A., Marmier, A., Marschinski, R., Martinez Turegano, D., Munoz Pineiro, A., Nardo, M., Ndacyayisenga, N., Pasimeni, F., Preziosi, N., Rancan, M., Rueda Cantuche, J.M., Rondinella, V., Tanarro Colodron, J., Telsnig, T., Testa, G., Thiel, C., Travagnin, M., Tuebke, A., Van den Eede, G., Vazquez Hernandez, C., Vezzani, A., Wastin, F., *China, challenges and prospects from an industrial and innovation powerhouse*, EUR 29737 EN, European Commission, Brussels, 2019, ISBN 978-92-76-03405-6, doi:10.2760/489414, JRC116516.

# EXECUTIVE SUMMARY

## Made in China 2025: a strategy to achieve industrial modernisation

This report analyses China's approach to attaining a dominant position in international markets through a combination of industrial, Research and Innovation (R&I), trade and Foreign Direct Investment (FDI) policies. It also offers an assessment of China's current position compared to the EU and US innovation systems across a range of dimensions.

China is rapidly becoming a major industrial competitor in high-tech and growth sectors. It aims, through the Made in China (MIC) 2025 strategy, to become a world leader in 10 key industrial sectors:

1. Next-generation IT;
2. High-end numerical control machinery and robotics;
3. Aerospace and aviation equipment;
4. Maritime engineering equipment and high-tech maritime vessel manufacturing;
5. Advanced rail equipment;
6. Energy-saving vehicles and new energy vehicles;
7. Electrical equipment;
8. Agricultural machinery and equipment;
9. New materials;
10. Biopharmaceutical and high-performance medical devices.

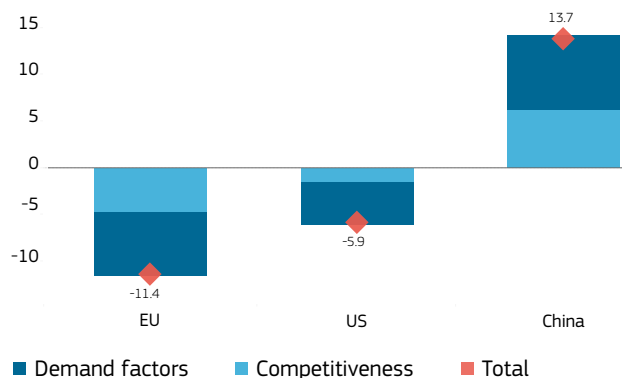
In these sectors, it strives to strengthen its domestic innovation capacity, to reduce its reliance on foreign technologies while moving up global value chains.

Made in China 2025 and related strategies can lead to a further deterioration of the competitive position of European firms in China

The MIC 2025 strategy aims to encourage substantial investments from national and regional governments to support domestic firms and improve knowledge infrastructures. The government intends to strengthen China's innovation capabilities and overall competitiveness by, in its own words, 'relying on market forces', though, in line with its 'socialist market economy', the state will remain central.

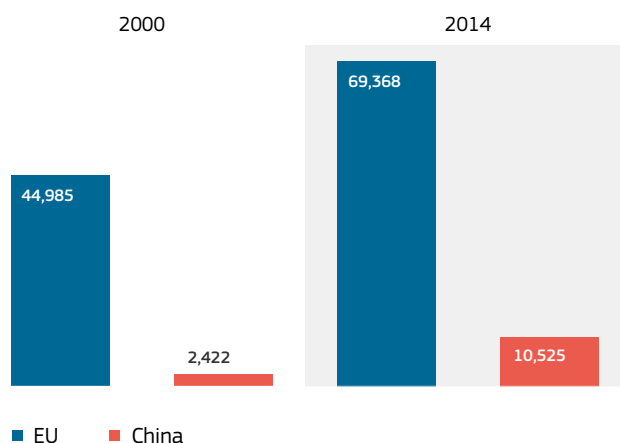
## China is quickly gaining ground on advanced economies in high tech value chains

China's share in manufacturing global value chains has risen sharply from 6% to 19% in the past 15 years at the expense of the EU (whose share dropped from 27% to 16%), through competitiveness gains and demand factors related to the growth of the Chinese market. While EU jobs embodied in exports to China remain significantly more productive than those of China to the EU, China is gradually closing the trade-related productivity gap.



**Figure 1:** World share in Global Value Chains; change in pct points 2000-2014

China's largest competitive gains vis-à-vis the EU are made in high-tech sectors related to computers and electronics, and electrical and mechanical engineering.



**Figure 2:** Labour productivity content of EU and Chinese bilateral exports

### China has become a competitor in fast growing high-tech sectors to reduce its reliance on foreign based technologies

Sectoral analyses also show a rapid improvement in China's competitiveness in the nuclear field; in new energy vehicles; in wind and Photo-Voltaic (PV) technologies; in Artificial Intelligence (AI) and some parts of advanced manufacturing technologies and robotics such as drones. Heavy reliance on China for access to rare earths (crucial to wind, photovoltaics and new energy vehicles) places European industry in a potentially vulnerable position.

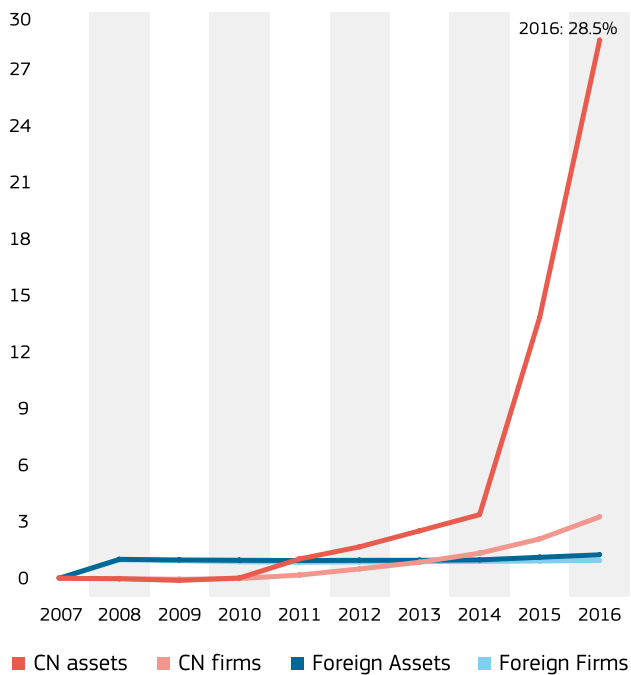
Developments in these domains show how Chinese companies (e.g. in solar and wind energy, robotics) can first gain domestic dominance, even with inferior technologies, by making use of protectionist measures. In a second phase, they may upgrade their technological capabilities through Research and Development (R&D), (forced) technology transfers and possibly industrial espionage. They can then expand internationally on the basis of (i) fierce price competition based on cost advantages that in some cases may result in dumping and (ii) Mergers and Acquisitions (M&As) of technologically advanced foreign companies.

The AI sector, however, is following a distinct accelerated development pattern where public sector leadership, through massive R&D funding, publicly controlled companies, innovative purchases from public authorities, favourable regulation, data policies and Intellectual Property Rights (IPR) regimes, together with a rapid international expansion and M&As by Chinese companies, may allow China to achieve its goal of becoming the world leader in AI by 2030. China could follow either or both approaches to achieve leadership in the other sectors targeted by MIC 2025.

### China is rapidly expanding its control of EU firms in key sectors to capture and exploit innovative ideas

In recent years, M&As have been carried out especially in the priority fields targeted by the MIC 2025 plan. In combination with the rapidly growing venture capital investments by Chinese firms abroad, this offers a means to capture and exploit innovative ideas and companies with the potential for growth.

Such mergers and acquisitions are shown to stimulate the R&D investment and labour productivity of Chinese firms. FDIs by Chinese firms offer opportunities for growth in Europe, but they may also bring risks, i.e. the loss of control over strategic technologies. The exposure of



**Figure 3:** Chinese shares in European firms;  
Growth (% , 2007=0)

Chinese banks also brings systemic risks to the global financial system.

### China provides uneven playing field for European companies

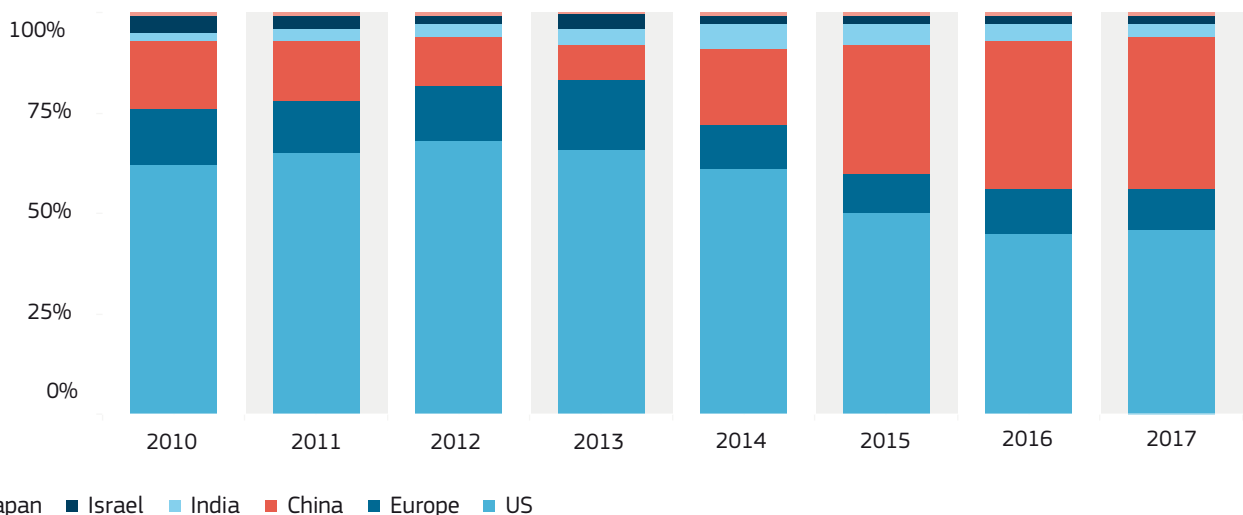
While the EU currently imposes few limitations on investments by Chinese firms, the reverse is not the case for European firms investing in China. In some sectors, European firms are forced to engage

in joint ventures with Chinese firms and transfer technology, including IPR. In others, FDI is blocked completely. With regards to post-entry conditions, the Chinese legal framework and unequal access to the Chinese market as well as government funding places European firms at a disadvantage compared to their Chinese counterparts.

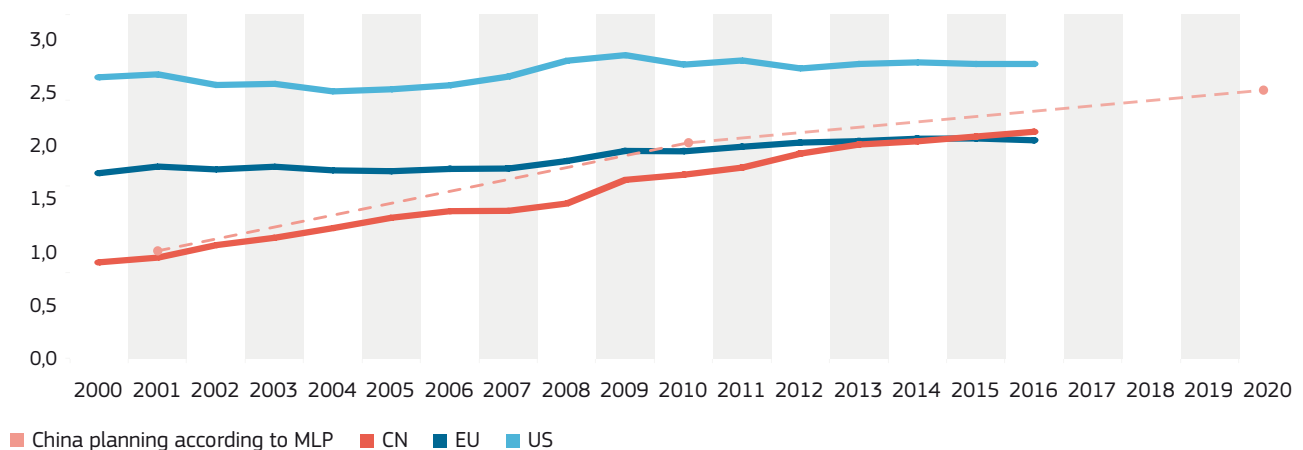
Some improvements have been made (e.g. IPR protection), but much remains to be done to achieve a level playing field for foreign companies. Analysts fear that MIC 2025 and related strategies could lead to a further deterioration of the competitive position of European firms in China. Thus the risk is that by the time a level playing field is achieved through, for instance, trade policy negotiations, Chinese companies might have become significantly more competitive than European companies in sectors characterised by high growth and technological content, both in the Chinese and global markets.

### China is the new research and innovation powerhouse in the innovation race

R&I play a central role in China's industrial strategies given its need to improve productivity and innovation capacity in response to the upward trend in wages and the increasing requirement for technologies that cannot be easily imported or



**Figure 4:** World Venture Capital trends 2010-2017



**Figure 5:** R&D intensity

acquired through FDI. China's public and private investments in R&D have risen rapidly over the past decade.

Chinese firms already have higher R&D expenditures than their EU counterparts and are fast catching up with the US. The output of the R&I system, measured in terms of patents and high impact publications, has grown exponentially.

At present, China is still heavily specialised in the natural Sciences and Technologies (S&T) related to Information and Communication Technology (ICT) and micro-electronics – including areas like quantum technology. China's position in the life sciences and biotechnology remains relatively weak, but one can observe strong activity in genomics. In order to achieve the MIC 2025 objectives, China will have to broaden its S&T portfolio.

International collaboration and highly skilled mobility are playing an important role in building China's R&I capabilities. US firms and researchers benefit from a more intense interaction with China compared to their EU counterparts, which may have negative long-term implications on the relative performance of European R&I systems.

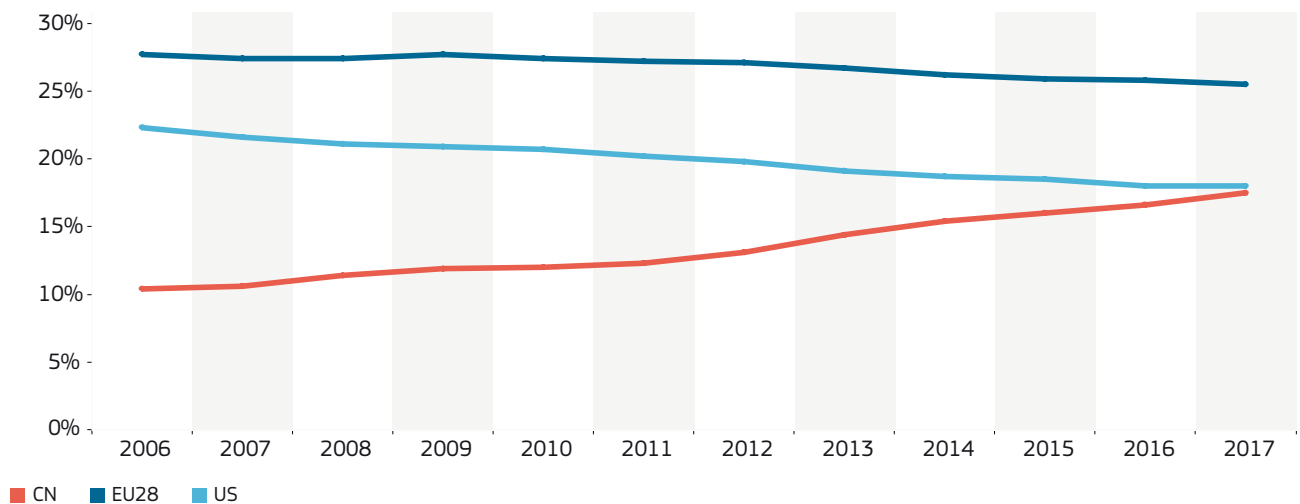
**Towards 2049: China is on track to compete with the EU and US for industrial and technological leadership**

A horizontal analysis of China's sectoral industrial performance shows that at present the largest

gains in competitiveness are in ICT-related fields, partially as a result of FDI conditions that have favoured domestic companies. As shown by the health and pharmaceutical sectors, however, protecting local firms through FDI restrictiveness alone can be insufficient for driving international success. A competitive domestic knowledge base is also important. China's performance seems to stem from a specific and advantageous combination of productivity-enhancing investments and technology transfer from foreign sources while exploiting sheltering framework conditions.

“ China's spending in R&D as a proportion of GDP is higher than in the EU ”

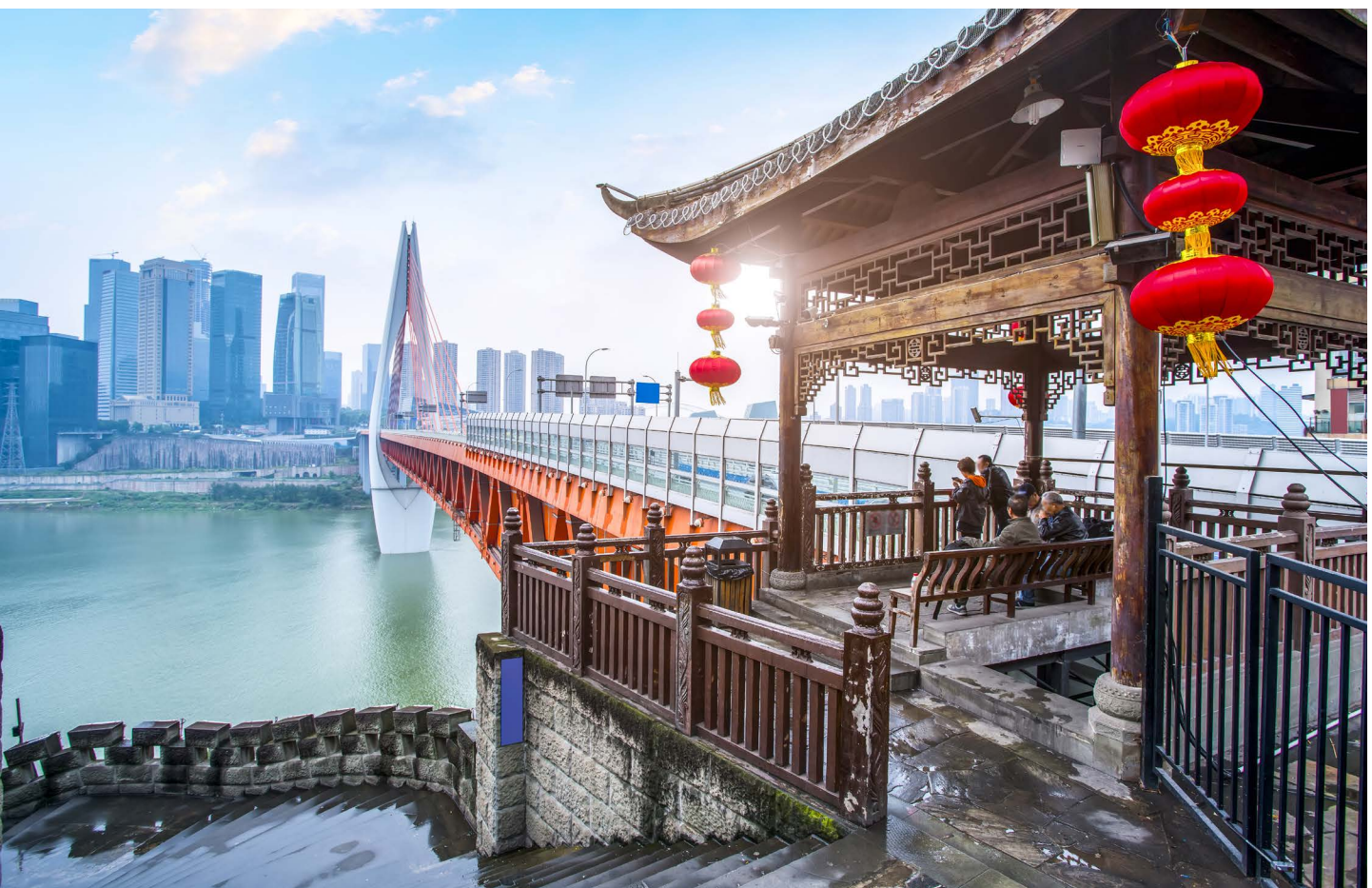




**Figure 6:** World share of high impact publications

This report concludes that China has become a major industrial competitor in several rapidly expanding high-tech sectors. The structural reforms and large investments implied by the Made in China 2025 strategy will further boost China's capabilities in the targeted high-tech fields. It may well result in China achieving its goal of becoming an innovation leader by 2049, if not well before that in specific areas. As a response, the EU will need to boost its industrial and R&I performance and develop a trade policy that can ensure a level playing

field for EU companies in China and for Chinese companies in the EU. Reciprocity is crucial. Meanwhile, the EU may also want to consider the potential need for protecting strategic assets from foreign investors, be they of Chinese or US origin. In doing so, it should take into account the substantial benefits that may arise from industrial investments from abroad.



## The European Commission's science and knowledge service

Joint Research Centre

### JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



**EU Science Hub**  
[ec.europa.eu/jrc](https://ec.europa.eu/jrc)



@EU\_ScienceHub



EU Science Hub - Joint Research Centre



EU Science, Research and Innovation



EU Science Hub



Publications Office  
of the European Union

ISBN 978-92-76-03405-6  
doi:10.2760/489414